

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Christella boydiae*

COMMON NAME: No common name

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

STATUS/ACTION

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 2001

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Ferns and allies, Thelypteridaceae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Oahu , Maui, and Hawaii

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Oahu and Maui

LAND OWNERSHIP: Federal, State, and private lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Christella boydiae* is a small to medium sized fern with reclining or erect stems. Large, tangled mass of roots form a holdfast. Fronds are stiffly upright, usually 10-30 centimeters (4-12 inches) long. The fronds are once-divided (Palmer 2003).

Taxonomy *Christella boydiae* was originally described in 1897 by Eaton. Iwats later moved the species to the genus *Thelypteris* (Palmer 2003). Warren H. Wagner moved the species to *Cyclosorus* and recognized two varieties in 1999: var. *kipahuluensis* and var. *boydiae* (Wagner *et al.* 1999b). In his 2003 review of all Hawaiian ferns, the most recent treatment of Hawaiian ferns, Palmer returned the species to *Christella* and did not recognize any varieties (Palmer 2003).

Habitat Typical habitat for this species is mesic to wet forest along streambanks (Joel Lau, Hawaii Natural Heritage Program, pers. comm. 1995; Arthur C. Medeiros III, National Biological Service and Dan Palmer, amateur pteridologist, pers. comms. 1999; Palmer 2003).

Historical and Current Range/Distribution Historically, this species was found on Oahu, Maui, and Hawaii (Palmer 2003). Currently, this species is found only on Oahu and Maui (Palmer

2003). This species is known from three populations totaling 362 to 412 individuals. The three populations are found in Kipahulu Valley and Waihoi Valley on Maui, and the Koolau Mountains of Oahu (J. Lau, pers. comm. 1995; A. C. Medeiros III and D. Palmer, pers. comms. 1999; Palmer 2003; Kapua Kawelo, U.S. Army, pers. comm. 2005). Current populations survive only at the extreme upper elevations of streambanks (Palmer 2003).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

This species is threatened by feral pigs (*Sus scrofa*) and goats (*Capra hircus*) that adversely modify habitat (A. C. Medeiros III and J. Lau, pers. comm. 1995). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitats on Oahu, Maui, and Hawaii. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs, introduced to Hawaii by Captain James Cook in 1778, became feral and invaded forested areas, especially wet and mesic forests and dry areas at high elevations. They are currently present on Oahu, Maui, and Hawaii, and two other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a). Pigs are the major threat to *Christella boydiae* (A. C. Medeiros III and J. Lau, pers. comm. 1995).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently populations exist on Kauai, Oahu, Maui, and Hawaii. Goats browse on introduced grasses and native plants, especially in drier and more open ecosystems. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). The habitats of the three populations were damaged in the past by goats, and these effects are still apparent in the form of alien vegetation and erosion. *Christella boydiae* is potentially threatened by direct damage from feral goats, such as trampling of plants and seedlings and erosion of substrate (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Culliney 1988).

Pig and goat exclusion fences protect one of the three known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

None known.

D. The inadequacy of existing regulatory mechanisms.

Pigs and goats are managed in Hawaii as game animals but may populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig and goat hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of goats or pigs to eliminate this threat to *Christella boydiae*. Pig and goat exclusion fences protect one of the three known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.

This species is threatened by alien plant species that adversely modify habitat (A. C. Medeiros III and J. Lau, pers. comms. 1995).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Christella boydiae*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Christella boydiae*, the Service believes nonnative plant species are a threat to *Christella boydiae*. The remaining unmanaged populations of *Christella boydiae* are still impacted by this threat.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Haleakala National Park is conducting ungulate control and weed control for habitat management in the area where one population is located.

SUMMARY OF THREATS:

The major threats to this taxon are pigs, goats, and nonnative plant species, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs and goats have been fenced out of one of the three populations where *Christella boydiae* currently occurs (Haleakala National Park) and nonnative plants are being controlled there. These on-going conservation efforts for this species benefit only one of the three known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
Moderate to Low	Imminent	Subspecies/population	6
		Monotypic genus	7
		Species	8
	Non-imminent	Subspecies/population	9
		Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by feral pigs and goats that degrade and/or destroy habitat, nonnative plants that compete for light and nutrients, man-made stream diversion, and erosion. *Christella boydiae* is potentially threatened by direct predation by feral pigs and goats. Threats to the habitat of *Christella boydiae* and to individuals of this species occur throughout its range and are expected to continue or increase without their control or eradication. Feral pigs and goats have been fenced out of one of the three populations where *Christella boydiae* currently occurs and nonnative plants have been reduced in the fenced area. These on-going conservation efforts for this species benefit only one of the three known populations. The species as a whole is still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

Imminence:

Threats to *Christella boydiae* from feral pigs and goats and nonnative plants are imminent because they are ongoing in two of the three known populations.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, one population of *Christella boydiae* benefits from ungulate and weed control conducted by the National Park Service in Haleakala National Park. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *C. boydiae* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:

Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Arthur C. Medeiros III of the National Biological Service in 1995; Joel Lau of the Hawaii Natural Heritage Program in 1995; and Daniel Palmer, amateur pteridologist, in 1995. We have incorporated additional information on this species from our files and the recent treatment of Hawaiian ferns (Palmer 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information was provided by these individuals and they were not able to clarify the current status of these plants in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Christella boydiae* in the Koolau mountains of Oahu was provided by Kapua Kawelo, U.S. Army.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). This species has been identified as rare by the late Warren H. Wagner of the University of Michigan and Dan Palmer, author of *Hawaii's Ferns and Fern Allies*, experts in Hawaiian ferns.

One species expert provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo*	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

- Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.
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- Corn, C.A., G. Clarke, L. Cuddihy, and L. Yoshida. 1979. A botanical reconnaissance of Kalalau, Honopu, Awaawapuhi, Nualolo and Milolii Valleys and shorelines—Na Pali, Kauai.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.
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- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123,

- Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii Heritage Program, The Nature Conservancy of Hawaii. 1990. Management recommendations for Na Pali Coast State Park, island of Kauai. Unpublished report prepared for Hawaii, Department of Land and Natural Resources, Division of State Parks, Honolulu. 18 pp.
- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.
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- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
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- Palmer, D.D. 2003. Hawai'i's Ferns and Fern Allies. University of Hawaii Press, Honolulu. 324 pp.
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- Tomich, P.Q. 1986. Mammals in Hawai'i; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
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- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai'i, Bishop Mus. Spec. Publ. 97:1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.
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- Wenkam, R. 1969. Kauai and the park country of Hawaii. Sierra Club, San Francisco. 160 pp.
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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/18/05
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones Jr.

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Date of annual review: September 19, 2005
Conducted by: Marie M. Brueggmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 20, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 17, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 17, 2005
Field Supervisor